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very great in all characters studied, may not be considered as having great significance, since the bringing in of still other pedigrees from other sections would doubtless have increased the range of variability. No perceptible correlation was found between earliness and height of the plants or between duration of bloom and height of plants. There appeared to be a slight negative correlation between the duration of bloom and weight, but this was very slight and possibly not significant. Between weight and height, as might be expected, there was considerable positive correlation, ranging from 0.274 ± 0.011 to 0.718 ± 0.006 . By securing data covering three years from the same series of plants, an interesting new relation has been developed, namely, the correlation between the condition of plants in one year as compared with the same plants in succeeding years, and for this correlation the author gives the name "coefficient of place-variation." This measures the extent to which an individual, found to have a given rank with respect to a variable character in one year, may be expected to hold the same rank in succeeding years, and is a very important consideration from the standpoint of the practical breeder. The correlation coefficients found ranged from 0.382 ± 0.010 to 0.585 ± 0.008 . The lowest correlation was found in comparisons between non-consecutive years, as when 1905 was compared with 1907. This would naturally be expected, since there are more disturbing factors in two years than in one. These coefficients are considered rather low, and are taken to indicate the importance of comparing individuals during several years as a safe basis for selection in economic breeding, since there are very good chances that an individual observed to be superior in one season may be inferior in succeeding seasons.—GEO. H. SHULL.

Seeds of horseradish.—It is a well known fact that the horseradish (*Cochlearia Armoracia*) is generally sterile, though it produces a great abundance of flowers and not infrequently produces capsules. BRZEZIŃSKI⁷ has induced the development of seeds by removing a circle of the bark from the upper portion of the root a short distance below the collum. Plants so treated produced a considerable number of good seeds, and in one year (1908) he secured 1500 seeds. Of 50 seeds sown in 1907, 30 produced plants, most of which succumbed to disease, but 9 of which grew to maturity. From the same (1906) crop, 200 seeds planted in 1908 produced only 20 seedlings, thus apparently indicating the rapid loss of vitality of the seeds. Only 6 of these reached maturity. These 15 mature seedling plants of the horseradish were not uniform, but were referable to two types, neither of which agreed with the characters of the parent. The ordinary horseradish is intermediate between these two types, though inclining much more strongly to one of them than to the other. Both types of seedlings proved to be somewhat fertile, producing a considerable number of seeds, even without the operation which induced seed-

⁷ BRZEZIŃSKI, J., Les graines du raifort et les résultats de leurs semis. Bull. Acad. Sci. Cracovie, Session of July 5, 1909. pp. 392-408. pls. 12-15.

production in the parent. Two hypotheses are offered to account for the appearance of these two types among the seedlings: (1) that they are mutations produced as a result of traumatism in accordance with the views of BLARINGHEM; and (2) that the ordinary horseradish is not a natural species as generally believed by taxonomists, but a hybrid, and that the two types of offspring produced from the seeds are partial or complete returns to its parent types. The author inclines to the latter view, and would interpret the sterility of the horseradish as due, not to the accentuated development of fleshy roots, but to a weakening of the sexual development, not infrequently found in hybrids. The reviewer is inclined also to the latter interpretation, and would point out the important bearing the author's method of securing seeds of the horseradish may have in its application to other sterile hybrids. Many experiments have been terminated by the failure of hybrids to produce seeds. It may be that some of these cases will yield to methods of treatment similar to that employed by BRZEZIŃSKI in securing seeds of horseradish.—GEO. H. SHULL.

The ecology of conifers.—STOPES and MOSS have discussed the xerophytism of conifers, and now GROOM⁸ considers a number of their ecological features. In the introductory statement three problems are outlined: the cause of their xerophytic foliage and tracheidal wood, the cause of their survival in competition with dicotylous trees, and the cause of the suppression of many forms in past ages. GROOM correctly concludes that not all conifers are xerophytic, in spite of their xerophytic leaf structure, calling attention to VON HÖHNEL's demonstration of high transpiration in the larch, and to his own experiments which show that coniferous wood, in spite of its tracheidal structure, may conduct water with a rapidity equal to that of a rapidly transpiring dicotylous tree. Attention is called to the fact that the aggregate leaf surface of a coniferous tree may exceed that of a dicotylous tree, because of the immense number of leaves. Indeed, GROOM regards the xerophytic structure of the leaf as a necessity in view of the great amount of exposed surface, and he applies the term "architectural xerophytism" to xerophytism that is dependent upon the organization of the plant rather than upon the direct influence of external factors upon the organs in question. In opposition to STOPES, GROOM regards the tracheidal nature of the wood as a feature of advantage rather than a feature necessitated by heredity, and notes that similar wood tends to occur in various evergreen dicotyls. The extinction of many conifers of past ages is attributed to their imperfect acclimatization, to the fact that they have a great number of insect and fungus enemies, and to their relatively slight power to react advantageously to new conditions. However, their architectural xerophytism makes it possible for them to thrive in nearly all situations, from those that are physically or physiologically dry

⁸ GROOM, PERCY, Remarks on the oecology of Coniferae. *Annals of Botany* 24: 241-269. 1910.